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## **Can Computers Build Muscles?**

Scientific approach to physical training



Code adi-pub-01258

Title Can Computers Build Muscles?

Subtitle Scientific approach to physical training

Name Muscle and Fitness

Author Paul Word

Published on Monday, August 9, 1993

**Subject** ACES; APAS; Baseball; Biomechanics; EMG; Exercise Machine;

Favorite; Media; Performance Analysis; Science; Sports; Volleyball

URL https://arielweb.com/articles/show/adi-pub-01258

Date 2013-01-16 15:40:51

Label Approved
Privacy Public

In this article, Paul Ward discusses the advancements in bodybuilding technology over the past 20 years, with a particular focus on the computerization of exercise equipment. He highlights the potential of these high-tech machines in providing individualized workouts, diagnosing muscular strengths and weaknesses, and programming optimal exercise routines. The article also introduces Ariel LifeSystems, a company producing advanced computerized exercise equipment. These machines, such as the CES 5000 Multi-Function machine and the CES 5000 Arm-Leg machine, offer a wide range of exercises and can store large volumes of training information for efficient program analysis. The article also discusses the advantages of these machines over traditional free weights and resistance equipment, including the ability to control and adjust exercise parameters, and the potential for unidirectional and bidirectional training exercises.

The article discusses the benefits of using computerized workout machines for bodybuilding training. These machines provide resistance for each exercise while matching the acceleration patterns encountered in natural movements. They also have the ability to add and subtract weight throughout the range of motion and measure the speed of motion. The article further explains different training programs such as work training, fatigue training, timed exercise, combination dynamic-isometric sticking point, spectrum training of intensity, and constant velocity training. These programs aim to control the volume of work, preselect the desired fatigue level, specify the time for the completion of a specific exercise, develop maximal recruitment of all types of muscle fibers, train the muscles at different speeds of movement, and perform isokinetic training with hydraulic resistance equipment. The article concludes by listing the reasons why computerized workout machines are at the cutting edge of bodybuilding training.

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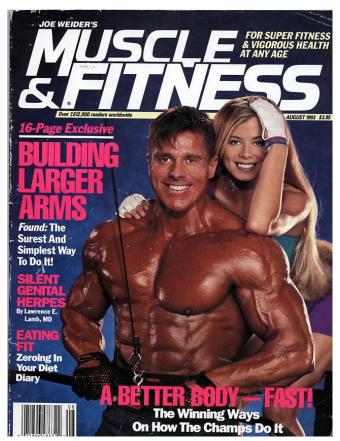
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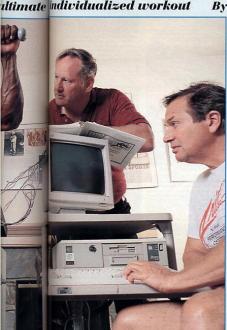
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Below find a reprint of the 12 relevant pages of the article "Can Computers Build Muscles?" in "Muscle and Fitness":





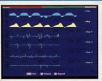




Plearcise System (CES).

"Het O'N OF TONORROW, TONAY
While high technology will always
feel a never ending evolution in exercise equipment, free weights will never
be replaced. They are the core tools of
the bodybuilder. Nevertheless, it's foolsh for the bodybuilder to overfook all
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sh for the bodybuilder to overfook all
stands with the stands of the stands
and the stands of the stands of the
stands of the future that has a unique
computerized high-tech equipment
area for spectalized evaluation and
and computers are interfaced to diagnoze muscular strengths and weaknesses and are designed to program
and control exercise routines for optimal guiss.



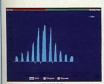


# FIGURE 1 COMMODATING RESISTANCE CURVE F A BENCH PRESS PUSHINGIPULING MOVEMENT WITH COMPARISON OF DIFFERENT TRAINING SESSIONS

DIFFERENT TRAINING SESSIONS upper curve is the pushing part of this ment and the bottom curve is the pulling. The start of the pushing movement is at eft and the finish is on the right. The of the pulling movement is at the right the finish is on the left. The performance less that raings session is represented by squares while today's performance is nestrated by the yellow curve.



BENCH PRESS PUSHING/PULLING DYNAM-ISOMETRIC STICKING YUNT :
wave shows three sticking point isometrice applications coupled within a series and repetitions of the bench presspull ment. Note the different shape of the curve (top) compared with the shape of sulling curve (bottom). The magnitude of ticking point forces of the pushing action gher than the sticking point forces of the value of the couple of the coup





BICEPS AND TRICEPS.

BICEPS AND TRICEPS.

BIS graph displays the strength curve, the displacement curve and the mascle recruit bench press pushing/pulling action. The top horizontal pattern shows the pushing action (the part above the horizontal line) and the pulling action (the part below the horizontal line) and the pulling action (the part below the horizontal line) and the pulling action (the part below the horizontal line) and the pulling action (the part below the horizontal pattern shows the muscle recruitment the displacement of the bar during the containers of the arterior detailed, pectoralis and the pulling action. The four bottom horizontal patterns show the muscle recruitment patterns for the arterior detailed, pectoralis



graph displays the curve plots of the puter programming of increasing resis-e of the pushing action of the bench smovement for each succeeding repeti-of an ascending pyramid in spectrum ing.



ISOKINETIC RESISTANCE CURVE OF A BENCH PRESS PUSHING/PULLING

FIGURE 6

CURVE PLOTS FOR SUCCEDING
REPETITIONS OF A BENCH PRESS PUSHING
PROGRAM IN SPECTRUM TRAINING
This graph displays the curve plots of the
computer programming of decreasing resisteres movement for each succeeding repetition of a descending pyramid in spectrum
training.

FIGURE 3
FATIGUE CURVE FOR A BENCH PRESS
PUSHING/PULLING MOVEMENT

PUSHNOPULING MOVEMENT
This graph displays the fattigue curve of a
bench prescipul movement. The top graph to
bench prescipul movement. The strong graph
the pulling movement. The strong for the
transport of the pulling moving from left to
cred and the white line shows the maximum
strength at each succeeding repetition. The
hophylulicer can set the level of ratigue as
(atrength, mass, cutting or shaping) will be
attained.

formance.
Those associated with the RDA are quick to point out that concepts like optimum intake" and "peak performance" are beyond the scope of the FNB. Perhaps. But in abdicating their advice-giving throne to others, the PNB is passing up the opportunity to provide guidance to consumers who most desire it. Today, as the III the dition of the Recommended Dietary Allouence is being prepared, it's time for the FNB to bring the RDAs in line with the current state of scientific knowledge.

### well-groomed

(Continued from page 48) weeks for the first three or four sesweeks for the first three or four ses-sions. The legs won't feel smooth un-til they've been waxed 2-3 times. Also, keep in mind that your skin will feel smoother the day after being waxed than it will immediately after.

WILL I HAVE AN ACNE BREAKOUT? This is an individual matter. Backs will break out quite frequently the first couple of times, so be sure to test this service at least one month before a competition. Usually if you keep on waxing, the breakouts stop.

WHAT ARE THE RULES
FOR WAXING?
No saura, no abrasives and no deodorant for 12 hours, but most importantly, no sun! This includes not only
natural sun, but tanning beds as well.
If you catch too many rays after a wax,
you will end up with different colored
skin on the treated areas — and it'll
last for months? last for months!

SHOULD I WAX MY WHOLE
BODY IN ONE SESSION?
If you are hairy, no. Have your legs
done, and then have your upper body
done later. If you aren't hairy, a fullbody wax, which includes legs, back,
arms, chest and underarms, should
take up to two hours for a competent
echnician.

After 16 years of waxing, I can wax a pair of legs in seven minutes — with minimal pain felt by the client. Usually it takes about half an hour.

### **HOW MUCH WILL IT COST?**

The cost varies depending on your size and hairiness. A full-body wax will set you back \$200-400 per treatment, but don't let that dissuade you. Not everybody will need a full-body treateverybody will need a full-body treat-ment. A lot of people just have their backs done, since this is a hard area for them to treat at home. Waxing

back alone costs \$20-40 and will need to be done only once a month.

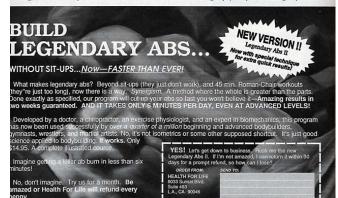
### IS WAXING FOR YOU?

IS WAXING FOR YOU?

Try it and see — you just never know. I personally never touch a razor to my body, and I am so used to the process that now I could fall asleep while being waxed. I have my full body done about every five weeks and remain nearly completely hairless in between. I lowe not ever having stubble and love not having to shave! □

### HI-TECH

(Continued from page 127)
computerized digital hydraulic resistor
pack instead of weights, springs or
manually adjusted hydraulic or pneumatic resistance. This helps ensure
safer, quieter and more efficient workouts. By using monitors and printers
with color graphics to illustrate the
individual's exercise performance, anybody who is even slightly computer lirerate will be able to follow a predetererate will be able to follow a predetermined exercise program or create a physical profile relating to personal



# strengths, weaknesses, speed, power and endurance. This equipment takes resistive exercise from the Iron Age to the Computer Age.

### MACHINE FEATURES

MACHINE FEATURES

The ultimate objective for any body-building exercise is to work the muscle at its maximum efficiency to achieve the desired goal. To effectively accomplish this objective, the body-builder must know and use the proper of the control of the proper of the control of the complete each repetition and set; and the proper according to the amount of time to complete each repetition and set; and the proper acceleration.

With these new machines, computers precisely control all these exercise requirements while at the same time recording volumes of information that of the set or exercise essions. No other exercise equipment adjusts to the individual bodybuilder as effectively or comprehensively as these cutting-edge devices. Thus they help ensure safety as well as effectiveness. Since all the parameters of exercise are programmed, computer controlled and automatically stored, the body-builder's only concern is to focus on exercise performance.

FIGURE 8
CURVE PLOTS FOR SUCCEEDING REPETITIONS OF A BENCH PRESS PUSHING ACTIC
IN A DESCENDING/ASCENDING PYRAMIDIN
PROGRAM IN SPECTRUM TRAINING

FREE WEIGHTS VS. THE NEW COOPULIFIEEZED MACHINES
Free veights and most conventional resistance coupliment are gravity dependent. Therefore, they are subject to inertia and the exerciser can apply resistance only in one direction. In using free weights, the bodybuilder is limited to the weight that can be moved through the weakers point in the range of motion control of the weight with the range of motion of the weight of the worked maximally through a full contraction potential. Furthermore, free weights and conventional resistance machines offer lite control of many of the exercise parameters listed above. The body-builder has to regulate the exercise. This is not efficient or objective by any stretch of the imagination, making it difficult for the bodybuilder to accurately sauge his or her performance.

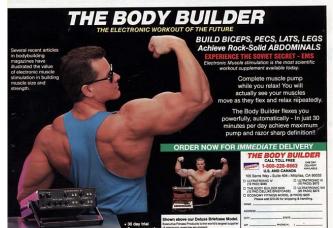
The CBS machines have a closed-loop, feedback-controlled mechanism that overcomes many of the other diversional machines. The mechanism provides the user with the flexibility and adaptability to exercise at any resistance or velocity pattern throughout the range of motion. Moreover,

these computerized machines are capable of modifying the feedback loop during the exercise to achieve a planned sequential or patterned progression of resistance or velocity for the optimum effects on muscle growth and strength. For example, an interactive closed-indu automatically exponds to the bodybuilder's performance up to 16,000 times per second.

responts to the doops of the service of the service

GOING BOTH WAYS

The Ariel machines can be utilized (Continued on page 238)



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### HI-TECH

HI-TECH

(Continued from page 235)
in either unidirectional or bidirectional modes. Unidirectional means that shortening muscle contractions (concentric) can be performed under resistance in only one direction if desired. The equipment can be easily returned to the starting position with minimal resistance in that mode. The contractions is the starting position with minimal resistance in that mode concentrations. The prime-mover muscle action is followed by an antagonistic muscle movement within the same exercise pattern. An example would be a curl action performed first, followed by elbow extension — or vice versa — within one full exercise movement. Another example is a pressing action followed immediately by a pulling action for one rep. Unidirectional or bidirectional training exercises have no negative (eccentric) muscle contractions.

indirections and bidirectional Unidirectional and bidirectional unidirectional and bidirectional exercises facilitate blood flow in the muscle, more effectively providing oxygen and nutrients and disposing of waste products in the muscle tissue. Unidirectional and bidirectional movements are new bodybuilding concepts that are very promising for providing exercise diversity and may be more effective and specific for building, strengthening and defining muscle mass.

Ariel's CES machines also allow the Ariel's CES machines also allow the bodybuilder to train either unilaterally (one limb only) or bilaterally (two limbs simultaneously). The actions for either are equally smooth and effec-tive, more so than that provided by free weights and traditional machines.

### THE ULTIMATE BUILDING AND SHAPING TECHNOLOGY?

SHAPING TECHNOLOGY?

A visionary feature of these new computerized machines is the ability to apply simple and noninvasive electory of the state of

with a specific transport of motion.

This helps take the guesswork out of selecting which routines and exer-

cises will produce optimal results. This revolutionary feature represents a quantum leap in bodybuilding training — a giant progression to a higher level of understanding of how to build a superior physique (see Figure 2).

### THE WORKOUTS

The Ariel machines are fantastic tools that have great capabilities — but you have to know what you're doing. So far, nine basic programs have been devised for these machines. have been devised for these machines. Many more subprograms will be devel-oped as bodybuilders, coaches and exercise scientists become more famil-iar with this new technology. The nine programs devised are as

The nine programs devised are as follows:

1) THE USER PROFILE PROGRAM The USER PROFILE PROGRAM The USER PROFILE PROGRAM The USER PROFILE PROGRAM and the USER PROFILE PROGRAM THE PROFILE PRO any specific exercise.
THE ACCOMMODATING RE-

for any specific exercise.

2) THE ACCOMMODATING RESISTANCE PROGRAM This exercise
mode can be programmed to increase
muscle mass, or to enhance the shape
of the muscle and improve local muscle endurance. An important feature of
this mode is that the machine perfect
by marches the strength curve of each
fis mode is that the machine perfect
by marches the strength curve of each
machine that the strength curve of the
Keep in mind that as you move
through a range of motion during an
exercise, your ability to apply force
changes as a consequence of the biomechanics of the joint system and the
length-tension curve of the muscletendon unit. In other words, the actual
muscular force output varies through
the range of motion based upon the
interaction of the muscle and bones.

31 human movement. Guly "incilligen" systems can precisely accommodate the changing resistance throughout the range of motion. Because the
computers perform this function, the

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bodybuilder can concentrate on maximally contracting the muscle at all points in the range of motion. The result: more growth. Again, free weights and conventional machines.

Moreover, the tauchines can be prospeed, which allows the user to vary the force as he or she desires. This realise the bodybuilder to train all muscle fibers from the slow-twitch bloes to the fast-twitch fibers— and every muscle fiber in between — by performing repetitions at different intensities (Figure 1).

3) THE ACCOMMODATING VELOCITY (ACCELERATION) PROGRAM.

CITY (ACCELERATION) PROGRAM While the accommodating resistance mode matches the strength curve of the specific individual, the accommodating velocity mode matches the specific individual velocity patterns.

Acceleration is involved in all exercise motions. This program provides the appropriate resistance for each exercise while matching the acceleration patterns encountered in natural movements or evolution or velocity pattern. This allows the bodybulder to train the muscles at velocities and acceleration patterns that have never been available before with free weights and conventional machines.

This mode also simulates the tradi-

This mode also simulates the tradi-tional isotonic movements common with free weights. In addition, the computerized machines have the abili-ty to 1) add and subtract weight throughout the range of motion; and 2) measure the speed of motion. 4) WORK TRAINING The main ob-jective of this training program is to control the volume of work. It can be programmed to benefit strength, mass, local muscular endurance and bodyfat reduction, but the best appli-action of this mode is to shape and define muscle. The work training mode requires

cation of this mode is to shape and define muscle.

The work training mode requires the user to complete a predetermined amount of work at a preselected velocity. The controlling factor is the amount of work to be performed. If you use a small amount of force, the number of repetitions needed will be greater and the length of time needed to achieve the amount of force will be congered to the control of the congression of the control of the congression of the control of the control

work divided by the number of repetitions needed to complete the preassigned work). Also, the time needed to perform the workload is another index of performance. For example, you may assign a workload of 10,000 pounds. The body-builder can perform this work by executing 100 repetitions, which would provide the work in the work

5) FATIGUE TRAINING Fatigue training allows the bodybuilder to pre-select the desired fatigue level. This takes the guesswork out of selecting the number of repetitions needed to

takes the guesswork out of selecting the number of repetitions needed to produce exhaustion.

The fatigue level is determined by the machine when two consecutive repetitions fall below the preselected fatigue level. For example, if a 75% fatigue level is preselected, the exercise will terminate when the use has ost 25% of his or her strength.

Sot 25% of his or his or

of Timen ExerkCise in this mode a certain amount of time is specified for the completion of a specifie acretism amount of time is specified for the completion of a specified specified time, the exercise will be terminated regardless of the amount of work or repetitions completed. In all, the timing function can be used to control the time allowed for the completion of a single set; group of sets; the time between sets; and the total time for a total group of services. This function allows for the equal time distribution for each exercise and the control of the total training time. This function can be applied to any (Continued on page 245)

### HI-TECH

(Continued from page 240)
bodybuilding objective.
7) THE COMBINATION DYNAMICISOMETRIC STICKING POINT

7) THE COMBINATION DYNAMICISOMETRIC STICKING POINT
THIS program comities a regular dynamic more. The length of time for the program comities a regular dynamic more. The length of time for the spearage sticking point can be set forom 1-5 seconds as desired. This program has two basic objectives. One is to develop maximal recruitment of all types of muscle fibers, which results in maximal increases in strength and hypertrophy. The second objective is to increase the weak points in the range of motion. The combination of dynamic and isometric exercise has some very good support in scientific literature regarding its effectiveness as a strength and mass builder. Nevertheless, up until the computer-controlled machiness, performing this type of trainfliend the other hand, make this effective brand of exercise much easier to do. There is great potential to develop mass and strength using this program (Figure 4), 8) SPECTRUM TRAINING OF INTENSITY

Spectrum training involves training the muscles at many different speeck.

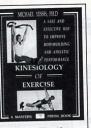
TENSITY
Spectrum training involves training the muscles at many different speeds of movement. By doing this, the body-builder can be sure to train fast-twitch, slow-twitch and intermediate muscle

slow-which and intermediate muscle fibers.

The basic aim of this training mode is to maximally develop mass and strength — and this program may be the best mass-training program in existence! Spectrum training comparison to the continuous program in the proof in successive repetitions — or a continuous program in the continuous

ETS	SLOW-	FAST-	
EIS	TO-FAST	TO SLOW	
	PATTERN	PATTERN	
1	Slow Speed:	Fast Speed:	
	4-6 Reps	9-12 Reps	
2	Medium Speed:	Medium Speed:	
	6-8 Reps	6-8 Reps	
9.4	Fact Connoch	Slow Speed-	

3 East Speed. Slow Speed: 9-12 Reps. 4-6 Reps One method of spectrum training each succeeding set. The first set is performed at a slow speed while the second set is performed at medium speed. Then the third set is performed at fast speed. Any desired number of



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sets and repetitions can be used with any speed of movement.

Another way of applying spectrum training is to say the speed of movement for each repetition in a set. For example, the first repetition is performed at slow speed while the sector of repetition is performed at a fast speed. Another of repetitions, sets of patterns can be programmed.

The batter method of applying spectrum training is really similar to pyramiding with free weights or conventually the set of the set of

Choice of Champions

Other versions can be used in combinations, i.e., ascending/descending or descending/ascending (figures 7 and 8) — whatever the bodybuilder desires. These programs can produce the ultimate pump.

9) CONSTANT VELOCITY TRAIN-ING Constant velocity train-ING Constant velocity training is isoki-netic training performed with hy-draulic resistance equipment. This is

also known as accommodating resistance. The velocity of the movement is constant while the force at each point in the range of motion varies with the biomechanics and muscle-tendinous unit length. As you move through the range of motion, the resistance will be range of motion the resistance will be range of the resistance will be range. This type of training benefits size, strength, shaping and local miscular endurance and helps reduce

Below are four different pyramiding formats that can be used in spectrum pyramiding training. Except for the numbers indicating amount of repeti-tions, each number in the chart repre-

sents the speed of movement in degrees per second. The fewer de-grees per second, the more the resist-ance applied during the exercise. The more degrees per second, the less the resistance.

tepetition	Ascending	Descending	Ascending/ Descending	Descending/ Ascending
1	20	130	20	120
2	30	120	40	100
3	40	110	60	80
4	50	100	80	60
5	60	90	100	40
6	70	80	120	20
7	80	70	120	20
8	90	60	100	40
9	100	50	80	60
10	110	40	60	80
11	120	30	40	100
12	130	20	20	120

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Jim Palmer, baseball Hall of Famer and timess enthusasts: "AB-Urrigionast mace me look great in my Juckys."

Ranners Winds-Grigionas:

Ranners Winds-Grigionas:

Albie Newman, Ten Nationat Obampion, featured on 1V5 Entertainment Tonight: "AB-Origionasts changed my life."

Por Franco Columbu. "Mr. Olympia," and prominent Los Angeles chiropractor: "AB-Origionast changed my life."

Gregory Hines: "AB-Origionast mace my dance!"

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bodyfat (Figure 9).

be programmed for dynamic calibra-

NEW GENERATION COMPUTERIZED EXERCISE SYSTEMS:
A QUANTUR LEAP FORWARD
A few reasons why the new computerized workout machines are at a tardiagnostic history is stored and is available for immediate recail.

10 Comparison information is visual and control velocity and resistance throughout the range of motion.

2) Variable velocity can be programmed to over 1,000 degrees per second in each direction for acceleration and exercise specificity.

3) Variable resistance can be programmed to over 1,000 degrees per second in each direction for acceleration and exercise specificity.

3) Variable resistance can be programmed to over 1,000 degree per second in each direction of ever 1,000 degree per second in each direction for ever 1,000 degree per second in each direction and exercise specificity.

3) Variable resistance can be programmed to over 1,000 degree per second in each direction.

4) Pyramiding of resistance or speed of each repetition lifted; the manual of the per second in each direction.

5) Velocity or resistance can be independently controlled in each direction of every repetition.

6) Velocity or resistance can be independently controlled in each direction of every repetition.

7) Computerized diagnostics and extended the programmed for dynamic calibration.

9) Each individual's exercise and diagnostic history is stored and is available for immediate recal.

10) Comparison information is visual and control of provious exercise data and compare them with current performances, training and rehabilitation goals set earlier.

1) The machines display a performance respect of each repetition lifted; the manual of the provides instant diagnostic history is stored and is available for immediate recal.

12) They display a performance to to time, the position of the bar and the total for each training session.

12) The calculate and report display and the provides instant diagnostic history is stored and isagonstic history is stored and diagnostic history is stored and diagnostic history is such as the color mon

seconds.

16) An endurance program can automatically reduce resistance with each repetition to accommodate the user's level of fatigue.

17) Comparison information can be displayed on the screen and printed with color graphics in a tabled format. Some of the comparisons include:

Present performance/previous performance.

performance.
• Pre-injury performance/postinjury

Actual performance/ideal per-

Actual person...
 Right limb.left limb.
 Extensors/flexors.
 Force/power/speed — any comparison combination.

parison combination.

18) Up to nine different exercise result formats may be selectively displayed on the monitor and copied by the printer.

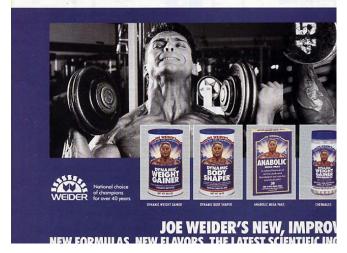
the printer.

19) In addition to the exercise results, the following data can be displayed:

Endurance by repetition.

Endurance by time.

Strength curve analysis.
 Fatigue curves.
 Paroformance goals can be displayed during an exercise for each movement. A target value can be high



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